

formed. The sheet was then annealed for 2.5 hours at 1130°C in a hydrogen atmosphere. At this anneal time, it is anticipated to obtain the steel of minimal carbon content, and produce the following soft magnetic properties: maximum permeability of 46,000 μ m, a core loss at different magnetic field/frequency (Gs/Hz) ranges, of $W_{10/50}=0.49\text{w/kg}$, $W_{10/400}=10.56\text{w/kg}$, $W_{5/1K}=11.5\text{w/kg}$, $W_{1/5K}=8.71\text{w/kg}$, $W_{10/400}=6.5\text{w/kg}$. Since the inventive process does not require the use of either costly starting materials or a CVD siliconizing step, large-scale economic production of high-silicon steel sheets of varying thickness made possible.

Example 5

A carbon containing high-silicon steel containing the following composition: 10 wt.% Si, 0.4965 wt.% carbon, less than 0.01% impurities consisting of one or more of Mn, P, S, Cr and Ni, balance iron. The sample was hot-rolled at 1000°C and the silicon steel exhibiting the following mechanical properties: The tensile ductility is over 15% at 200°C and increases to over 60% at 500°C. The yield strength is 800MPa at 200 to 400°C and 650MPa at 500°C.

What's claimed is:

1. A high silicon steel comprises 5-10 wt.% silicon, 0.007-1 wt.% carbon; less than 0.01 wt.% impurities consisting of one or more of Mn, P, S, Cr and Ni; and balance Fe.
2. A method of making a silicon steel, said method comprising adding about 0.01 to about 1.0 wt.% carbon to a steel containing from about 5 to 10 wt.% Si and subsequently homogenizing said steel at a temperature from about 1200°C to up to less than the melting point of said steel for a time sufficient to substantially remove most of the secondary phases from said steel, said homogenization process is carried out in a protective environment.
3. A method according to claim 2, wherein said homogenizing process is carried out in a protective environment, defined as a non-oxidizing environment, a de-carburizing environment or a vacuum.
4. A method according to claim 2, wherein said method using a thermo-mechanical control process to tailor the carbon content.
5. A method according to claim 2, wherein conventional metal working methods can be used to produce carbon-containing high-silicon steel sheets of various thickness, the thickness of the sheet is of 0.5mm, 0.35mm and 0.1mm respectively, a controlled microstructures for such sheets would have substantially uniform grains approximating to the thickness of the sheet, e.g., on the order of 0.5mm, 0.35mm and 0.1mm, respectively.
6. A method according to claim 5, wherein said conventional metal working methods comprise at least one of the following steps: (1) continuous casting and continuous hot rolling with rolling temperature between 600°C and 1000°C, ingot casting is continuously hot-rolled at temperature between 600°C and 1000°C; (2) combination of hot-rolling and cold-rolling with temperature between room temperature up to 500°C to produce thin sheets; (3) combination of hot-rolling of a single sheet and hot-rolling of double or multiple sheets to produce thin sheets.
7. A method according to claim 2, wherein the silicon steel produced by the method having a room temperature ductility of at least 10%; an elongation of greater than 20% from 200°C

to 800°C, and greater than 100% at or above 800°C; a strength of about 600MPa from room temperature to about 500°C; an oxidation rate of 0.01g/m² at 500°C after 50 hours of air exposure; and exhibiting the following soft magnetic properties: maximum permeability of 46,000μm, a core loss at different frequency ranges, of $W_{10/50}=0.49\text{w/kg}$, $W_{10/400}=10.56\text{w/kg}$, $W_{5/1K}=11\text{w/kg}$, $W_{1/5K}=8.71\text{w/kg}$, $W_{0.5/10}=6.5\text{w/kg}$.